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Richmond Fed Research Digest

Externally published research by Richmond Fed economists in the Bank's Research Department published from June 1, 2020, through December 31, 2021

The Richmond Fed produces several publications that feature the work of economists in its Research Department, but those economists also publish extensively in other venues. The Research Digest brings this work together in one place.

Student Loan Borrowing and Repayment Decisions: Risks and Contingencies

By Kartik Athreya, Christopher Herrington, Felicia Ionescu and Urvi Neelakantan
Handbook of the Economics of Education, *forthcoming*

Stock Market Participation: The Role of Human Capital

By Kartik Athreya, Felicia Ionescu and Urvi Neelakantan
Review of Economic Dynamics, *forthcoming*

While human capital accumulation is significant early in life, stock market participation is limited. As individuals age, this pattern is reversed. In this paper, we show that—when disciplined to match the substantial heterogeneity observed in earnings—a life-cycle portfolio choice model augmented to allow human capital investment delivers stock market participation over the life cycle consistent with the data. Key to our finding is that returns to human capital, unlike those to stocks, depend on both individual characteristics and the amount of time invested. Our results also suggest that when human capital accumulation is endogenous, it is short sales constraints on stocks, and not borrowing constraints, that limit engagement with the stock market.

Efficient VAR Discretization

By Grey Gordon
Economics Letters, *July 2021, vol. 204*

Tensor-grid discretization of VARs is inefficient. In particular, when there are just a few variables or the VAR components are correlated, this approach creates large inefficiencies because some discretized states will be visited with only vanishingly small probability. I show how to construct an efficient grid by either pruning these low-probability states or working directly with sparse grids. Efficient grids vastly improve accuracy for a given grid size or, conversely, vastly reduce the number of states required to attain a given level of accuracy.

https://doi.org/10.1016/j.econlet.2021.109872

Forecasting the COVID-19 Epidemic: The Case of New Zealand

By Paul Ho, Thomas A. Lubik and Christian Matthes
New Zealand Economic Papers, *forthcoming*

We estimate a statistical model for COVID-19 cases and deaths in New Zealand. New Zealand is an important test case for statistical and theoretical research into the dynamics of the global pandemic since it went through a full cycle of infections. We choose functional forms for infections and deaths that incorporate important features of epidemiological models but allow for flexible parameterization to capture different trajectories of the pandemic. Our Bayesian estimation reveals that the simple statistical framework we employ fits the data well and allows for a transparent characterization of the uncertainty surrounding the trajectories of infections and deaths.

https://doi.org/10.1080/00779954.2020.1842795

How to Go Viral: A COVID-19 Model with Endogenously Time-Varying Parameters

By Paul Ho, Thomas A. Lubik and Christian Matthes
Journal of Econometrics, *forthcoming*

We estimate a panel model with endogenously time-varying parameters for COVID-19 cases and deaths in U.S. states. The functional form for infections incorporates important features of epidemiological models but is flexibly parameterized to capture different trajectories of the pandemic. Daily deaths are modeled as a spike-and-slab regression on lagged cases. Our Bayesian estimation reveals that social distancing and testing have significant effects on the parameters. For example, a 10 percentage point increase in the positive test rate is associated with a 2 percentage point increase in the death rate among reported cases. The model forecasts perform well, even relative to models from epidemiology and statistics.

https://doi.org/10.1016/j.jeconom.2021.01.001

Quarantine, Contact Tracing and Testing: Implications of an Augmented SEIR Model

By Andreas Hornstein
The B.E. Journal of Macroeconomics, *forthcoming*

I incorporate quarantine, contact tracing and random testing in the basic SEIR model of infectious disease diffusion. A version of the model that is calibrated to known characteristics of the spread of COVID-19 is used to estimate the transmission rate of COVID-19 in the U.S. in 2020. The transmission rate is then decomposed into a part that reflects observable changes in employment and social contacts and a residual component that reflects disease properties and all other factors that affect the spread of the disease. I then construct counterfactuals for an alternative employment path that avoids the sharp employment decline in the second quarter of 2020, but also results in higher cumulative deaths due to a higher contact rate. For the simulations a modest permanent increase of quarantine effectiveness counteracts the increase in deaths, and the introduction of contact tracing and random testing further reduces deaths, although at a diminishing rate. Using a conservative assumption on the statistical value of life, the value of improved health outcomes from the alternative policies far outweighs the economic gains in terms of increased output and the potential fiscal costs of these policies.

https://doi.org/10.1515/bejm-2020-0168

End-of-Life Medical Expenses

By Eric French, John Bailey Jones, Elaine Kelly and Jeremy McCauley
Handbook of Aging and the Social Sciences, *Jan. 9, 2021, Ninth Edition, pp. 393-410*

In this review, we document end-of-life medical spending: its level, composition, funding and contribution to aggregate medical spending, both for the United States and abroad. We discuss how end-of-life expenses affect household savings and other financial behavior such as insurance choices. Lastly, we review economic evidence on the efficacy of medical spending at the end of life, assessing the value of palliative and other care for both longevity and patient satisfaction.

https://doi.org/10.1016/C2017-0-03920-4

Income Volatility and Portfolio Choices

By Yongsung Chang, Jay H. Hong, Marios Karabarbounis, Yicheng Wang and Tao Zhang
Review of Economic Dynamics, *forthcoming*

Based on administrative data from Statistics Norway, we find economically significant shifts in households' financial portfolios around individual structural breaks in labor-income volatility. According to our estimates, when income risk doubles, households reduce their risky share of financial assets by 5 percentage points, thus tempering their overall risk exposure. We show that our estimated risky share response is consistent with a standard portfolio choice model augmented with idiosyncratic, time-varying income volatility.

https://doi.org/10.1016/j.red.2021.04.004

The Impact of Rising Temperature on U.S. Economic Growth

By Riccardo Colacito, Bridget Hoffmann and Toan Phan
World Scientific Encyclopedia of Climate Change, *2021, pp. 133-138*

Economic research on the impact of higher temperatures on economic activity in developed countries has traditionally focused on economic activities that are naturally exposed to outdoor weather conditions, primarily agriculture. However, agriculture is a small fraction of total economic production in most developed countries, such as the United States. Colacito, Hoffmann and Phan (2019) provide a more complete picture of the economic effects of higher temperatures in the United States by documenting a strong negative effect of rising summer temperatures on a broad range of sectors of the U.S. economy, including finance, insurance and real estate. Furthermore they show that these effects are particularly strong during the summer season and have been subject to acceleration during the last 20 years.

https://doi.org/10.1142/9789811213960_0019

The Information Content and Statistical Properties of Diffusion Indexes

By Santiago Pinto, Pierre-Daniel Sarte and Robert Sharp
International Journal of Central Banking, *September 2020, vol. 16, no. 4, pp. 47-99*

We study diffusion indexes constructed from qualitative surveys to provide real-time assessments of various aspects of economic activity. In particular, we highlight the role of diffusion indexes as estimates of change in a quasi-extensive margin and characterize their distribution, focusing on the uncertainty implied by both sampling and the polarization of participants' responses. Because qualitative tendency surveys generally cover multiple questions around a topic, a key aspect of this uncertainty concerns the coincidence of responses, or the degree to which polarization co-moves, across individual questions. We illustrate these results using microdata on individual responses underlying different composite indexes published by the Michigan Survey of Consumers. We find a secular rise in consumer uncertainty starting around 2000, following a decade-long decline, and higher agreement among respondents in prior periods. In 2014, six years after the Great Recession, uncertainty arising from the polarization of responses in the Michigan Survey stood at its highest level, coinciding with the weakest recovery in U.S. postwar history. The formulas we derive allow for simple computations of approximate confidence intervals, thus affording a more complete real-time assessment of economic conditions using qualitative surveys.

https://www.ijcb.org/journal/ijcb20q3a2.htm

From the Regional Economy to the Macroeconomy

By Santiago Pinto and Pierre-Daniel Sarte
Handbook of Real Estate and Macroeconomics, *forthcoming*

The chapter reviews the recent literature that bridges urban and regional economics to macroeconomics. It highlights the different ways in which the study of economic allocations across space, and the forces that determine those allocations, also end up shaping aggregate outcomes of concern to macroeconomists.

https://www.e-elgar.com/shop/usd/handbook-of-real-estate-and-macroeconomics-9781789908480.html

Wholesale Funding Runs, Global Banks' Supply of Liquidity Insurance, and Corporate Investment

By Ricardo Correa, Horacio Sapriza and Andrei Zlate
Journal of International Economics, *November 2021, vol. 133*

Using supervisory data on the U.S. branches of foreign banks and their syndicated loans, we show that the branches of euro-area banks suffered a liquidity shock in the form of reduced access to wholesale funding from U.S. money market funds during the European sovereign debt crisis. Affected branches cut lending to U.S. firms mostly in the form of revolving credit and along the extensive margin, as increased funding from their parents only partially offset the liquidity shortfall. This shock was amplified by the reaction of exposed U.S. firms, which responded to the loss of credit lines by reducing investment and building up cash reserves. Our findings highlight the impact of funding stress encountered by global banks on firms' investment and precautionary savings.

https://doi.org/10.1016/j.jinteco.2021.103519

Local Industrial Policy and Sectoral Hubs

By Esteban Rossi-Hansberg, Pierre-Daniel Sarte and Felipe Schwartzman
AEA Papers and Proceedings, *May 2021, vol. 111, pp. 526-531*

We study the desirability of industrial policies that generate sectoral hubs using a quantitative spatial model with cognitive nonroutine and other occupations. The productivity of each occupation in an industry depends on sector-specific production externalities, which we estimate using a model-implied instrumental variable approach. We find that the optimal policy gives rise to national hubs in coastal cities in tradable services, like professional services, and smaller regional hubs in less tradable services, like health and education. The optimal policy prescribes developing manufacturing in smaller towns. We decompose the implied changes in local costs and the available varieties in each sector.

https://doi.org/10.1257/pandp.20211076

Local Scars of the U.S. Housing Crisis

By Saroj Bhattarai, Felipe Schwartzman and Choongryul Yang
Journal of Monetary Economics, *April 2021, vol. 119, pp. 40-57*

The 2006–09 U.S. housing crisis had scarring local effects. For a given county, a housing shock generating a 10 percent reduction in housing wealth from 2006 through 2009 led to a 4.4 percent decline in employment by 2018 and a commensurate decline in value added. This persistent local effect occurred despite the shock having no significant impact on labor productivity. The local labor market adjustment to the housing shock was particularly costly: Local wages did not respond, and long-run convergence in the local labor market slack instead took place entirely through population losses in affected regions. Moreover, the 2002–06 housing boom does not generate significant employment gains, indicating that the employment losses relative to 2006 are also losses relative to the counterfactual case in which there was no housing cycle.

https://doi.org/10.1016/j.jmoneco.2021.02.001

Playing With Money

By Douglas Davis, Oleg Korenok, Peter Norman, Bruno Sultanum and Randall Wright
Journal of Economic Behavior & Organization, *forthcoming*

Experimental work in monetary economics is usually based on theory that incorporates an infinite horizon. Yet, hard constraints on laboratory sessions lead to finite times when the game must (with probability 1) end, and then simple backward induction implies monetary equilibria cannot exist. Hence, these experiments cannot evaluate subjects' ability to settle on the use of money as a medium of exchange, that ameliorates trading frictions, as an equilibrium outcome. To address this, we present some finite-horizon games where monetary exchange is an equilibrium outcome, and report some experimental results using these games.

https://doi.org/10.1016/j.jebo.2020.06.031

Discussion of "Currency Stability Using Blockchain Technology"

By Bruno Sultanum
Journal of Economic Dynamics and Control, *May 2021*

The volatility of cryptocurrencies hinders their ability to be media of exchange or stores of value, leading to the implementation of exchange-rate pegs in an attempt to stabilize these currencies. This strategy has been used by cryptocurrencies such as US Dollar Tether, Steem Backed Dollar and TrueUSD and was previously adopted in countries such as Brazil, Mexico and Argentina. However, an exchange-rate peg is vulnerable to speculative attacks if it is not 100 percent backed by reserves, as discussed in Obstfeld (1996). Using insights from the bank-run literature, Routledge and Zetlin-Jones (2018) build on Green and Lin (2003) and propose a model of speculative attacks. They show that adjustments to the exchange rate can prevent speculative attacks in equilibrium. They also show how to implement such contracts using blockchain technology. In this discussion paper, I provide a cautionary tale. I show also in a version of Green and Lin (2003) that the information content in the blockchain prevents agents from attaining all the gains from risk sharing — highlighting the downsides of too much public information.

https://doi.org/10.1016/j.jedc.2021.104156

An Information-Based Theory of Financial Intermediation

By Zachary Bethune, Bruno Sultanum and Nicholas Trachter
The Review of Economic Studies, *forthcoming*

We build a theory of financial intermediation based on the premise that some investors are better able to figure out the trade motives of their counterparties in bilateral meetings — screening experts. We solve for the equilibrium market structure and study how information asymmetries stemming from heterogeneity in screening expertise shape up the core-periphery trade structure. In particular, the core of the market is populated by screening experts: They have the largest share of trade volume, are actively engaged in middleman activity and trade with the most counterparties. Using transaction-level micro data and information disclosure requirements, we provide extensive evidence consistent only with a theory of financial intermediation building on screening expertise.

https://www.restud.com/paper/an-information-based-theory-of-financial-intermediation/

Idea Diffusion and Property Rights

By Boyan Jovanovic and Zhu Wang
National Bureau of Economic Research Working Paper No. 28019, *October 2020*

We study the innovation and diffusion of technology at the industry level. We derive the full dynamic paths of an industry's evolution, from birth to its maturity, and we characterize the impact of diffusion on the incentive to innovate. The model implies that protection of innovators should be only partial due to the congestion externality in meetings in which idea transfers take place. We fit the model to the early experiences of the automobile and personal computer industries both of which show an S-shaped growth of the number of firms.

https://doi.org/10.3386/w28019

Lending Relationships and Optimal Monetary Policy

By Zachary Bethune, Guillaume Rocheteau, Russell Wong and Cathy Zhang
The Review of Economic Studies, *forthcoming*

We construct and calibrate a monetary model of corporate finance with endogenous formation of lending relationships. The equilibrium features money demands by firms that depend on their access to credit and a pecking order of financing means. We describe the mechanism through which monetary policy affects the creation of relationships and firms' incentives to use internal or external finance. We study optimal monetary policy following an unanticipated destruction of relationships under different commitment assumptions. The Ramsey solution uses forward guidance to expedite creation of new relationships by committing to raise the user cost of cash gradually above its long-run value. Absent commitment, the user cost is kept low, delaying recovery.

https://doi.org/10.1093/restud/rdab077

Payments on Digital Platforms: Resiliency, Interoperability and Welfare

By Jonathan Chiu and Russell Wong
Journal of Economic Dynamics and Control, *forthcoming*

Digital platforms, such as Alibaba and Amazon, operate an online marketplace to facilitate transactions. This paper studies a platform's business model choice between accepting cash and issuing tokens, as well as the implications for welfare, resiliency and interoperability. A cash platform free rides on the existing payment infrastructure and profits from collecting transaction fees. A token platform earns seigniorage, albeit bearing the costs of setting up the system and holding reserves to mitigate the cyber risk. Tokens earn consumers a return, insulating transactions from the liquidity costs of using cash, but also expose them to the remaining cyber risk. The platform issues tokens if the interest rate is high, the platform scope is large, and the cyber risk is small. Unbacked floating tokens with zero transaction fees or interest-bearing stablecoins can implement the equilibrium business model, which is not necessarily socially optimal because the platform does not internalize its impacts on off-platform activities. The model explains why Amazon does not issue tokens, but Alipay issues tokens circulatable outside its Alibaba platforms. Regulations such as a minimum reserve requirement can reduce welfare.

https://doi.org/10.1016/j.jedc.2021.104173

Product Life Cycle, Learning and Nominal Shocks

By David Argente and Chen Yeh
The Review of Economic Studies, *forthcoming*

This paper documents a new set of stylized facts on how pricing moments depend on product age and emphasizes how this heterogeneity is crucial for the amplification of nominal shocks to the real economy. Exploiting information from a unique panel containing billions of transactions in the U.S. consumer goods sector, we show that our empirical findings are consistent with a narrative in which firms face demand uncertainty and learn through prices. Such a mechanism of active learning from prices can strongly influence an economy's aggregate price level and can thus be important for assessing the degree of monetary non-neutrality. To quantify this, we build a general equilibrium menu cost model with active learning and exogenous entry that features heterogeneity in pricing moments over the life cycle of products. Under this setup, firms engage

in active learning to deal with uncertainty on their demand curves. Firms choose prices not only to maximize static profits, but also to create signals to obtain valuable information on their demand. In the calibrated version of our model, the cumulative real effects of a nominal shock are more than three times as large compared to a standard price-setting model. The main intuition behind this result is that active learning weakens the selection effect. Price changes are mainly determined by forces of active learning and, hence, become more orthogonal to aggregate shocks, which reduces the aggregate price flexibility of the economy.